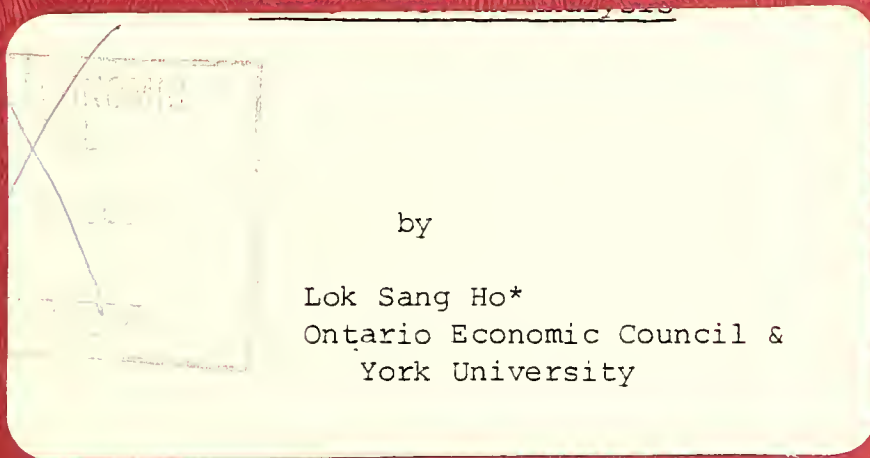


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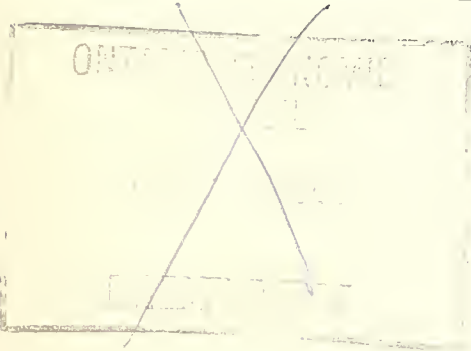


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The Cost-Effectiveness of Alternative Investment

Incentives: an Analysis



by

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Abstract

Using the net-worth maximization assumption the author analyses the cost-effectiveness of alternative investment incentives. For firms that currently pay taxes, direct investment subsidies and immediate deductions for investment expenditures are formally identical and are superior to tax rate reductions in terms of cost-effectiveness. In general, the cost-effectiveness of the instruments is highly sensitive to changes in the expected rate of return, the tax rate, the discount rate, the economic life of the capital assets, and the implicit or explicit subsidy rate.

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own.

The present paper presents a simple model of investment behaviour that permits us to derive a number of analytical results regarding the cost-effectiveness of several investment incentives. While there is a vast literature in this area, most studies are empirical, often using the framework of the flexible accelerator.¹ Unfortunately, conclusions drawn from statistical studies sometimes conflict, and even large scale simulation models may yield different results reflecting possible specification and data problems which are difficult to resolve.² Thus while Auerbach and Summers(1978) using the DRI model found the investment tax credit ineffective as an instrument to stimulate investment³, Braithwaite (1983) using the Candide 2.0 model found both the corporate tax reduction and the investment tax credit highly cost-effective.⁴ Although a general equilibrium approach is conceptually more appropriate in analysing problems with macroeconomic implications than a partial equilibrium one, it is very difficult to choose between highly complex models when they produce conflicting results. The present study is a partial equilibrium effort that focuses on the firm as a decision unit. As such, it suffers from the drawback of ignoring feedbacks that may significantly affect an estimate of cost-effectiveness. However, it also enjoys the advantage of providing the researcher with a better idea of how the underlying assumptions affect the results. While we make no claim that our results can readily be given an economy-wide interpretation, it does highlight the many reasons why the same incentive may have different effectiveness depending on the circumstances.

While interest in ways to stimulate investment is widespread among policy makers, as can be inferred from many government budgets, most theorists are more interested in the neutrality of the tax-cum-incentive system. In the view of many theorists, investment incentives should be designed to offset the tendency of the tax system to bias against savings



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and investment(See Bradford(1981), Auerbach(1979), Auerbach & Summers(1978)). It is not the purpose of this paper to decide whether any given investment incentive is efficient in the sense of preserve the neutrality of the tax-cum-incentive system. We simply start from the presumption that, whether it is the result of distortions created by the tax system or market failures caused by a discrepancy between social and private rates of return, the prevailing investment levels are inadequate. In response to the desire of many policy makers to look for those incentives that will generate the largest "bang for the buck", the present paper focuses narrowly on the cost-effectiveness of various investment incentives.⁵

Section I will develop and describe the model. In Section II we will use this model to analyse the cost effectiveness of (i) capital cost allowance and other deductions from taxable income, (ii) direct investment subsidies⁶, and (iii) reduction in the corporate tax rate. After introducing the concepts of an average cost effectiveness ratio and a marginal cost effectiveness ratio, we will derive the limiting deductions and subsidy rates beyond which one dollar of incentive expenditure results in less than one dollar of additional investment. Similarly, we will also derive the limiting tax rate below which further reductions will induce less investment than the tax revenue forgone. We find the cost-effectiveness of the incentives highly sensitive to changes in the expected rate of return, the tax rate, the discount rate, the economic life of the capital assets, as well as the implicit or explicit subsidy rate. This clearly goes some way towards explaining why empirical estimates of these ratios are so imprecise and subject to large errors.⁷ Section III will analyse the effect of risk-averse behaviour on the relative effectiveness of the investment incentives. Finally, Section IV will present the concluding remarks.

I. A Simple Model of Investment

The central assumption of this model is that investors invest to maximize the net worth of their firms. This assumption underlies the neoclassical model of investment behaviour.⁸ As well, it is consistent with Tobin's q theory, which essentially says that so long as the market value of equity investment exceeds the replacement cost of capital assets, investment should increase.⁹ It has been demonstrated recently that these two approaches are formally identical.¹⁰ Thus, net worth maximization is a standard assumption in the investment behaviour literature.

We adopt the commonly used assumption that all functions are differentiable. For each firm the opportunities for investment are continuous in the sense that the profitability of investment spending declines continuously with an increase in investment spending. We will, in addition, make the simplifying assumption that the firm is considering investment in one class of homogeneous assets. This is to avoid the need to worry about the heterogeneity of investment projects, particularly with regard to their economic lives.

Let $q(I)$ be the expected rate of return over the economic life of the assets to be acquired with expenditure dI when total investment is at level I . $q(I)$, therefore, corresponds to the marginal efficiency of capital as envisaged by Keynes--even though in most contexts Keynes had in mind an aggregate MEC schedule.¹¹ The terminal value of investment dI is therefore $(1 + q(I))dI$. This is integrated over the level of investment I_0 , to obtain:

$$(1) \quad \int_0^{I_0} (1 + q(I)) dI$$

Now define an "average rate of return" g such that:

$$(2) \quad I_0 (1 + g) = \int_0^{I_0} (1 + q(I)) dI$$

We assume that the rate of discount r is an increasing function of investment. As financing requirements increase, so will the opportunity cost of funds invested. This may be due to the higher cost of external financing as compared with internal financing.¹² Greater allocation of retained earnings for investment means less funds available for working capital purposes. Increasing the amount of money borrowed will increase the debt-equity ratio, causing lenders to demand more collateral or higher interest charges to reflect increasing insolvency risks. This assumption is not at all essential to our conclusions. It only permits us to derive a more general expression for the optimal investment level from the point of view of the firm. To obtain results for the case where the discount rate is not a function of investment, we simply set the relevant derivative to zero when interpreting the results. Because of diminishing returns, $\partial g / \partial I < 0$.

We now write a "net worth increase function" as follows:

$$(3) \quad W = \frac{1 + g(I)}{1 + r(I)} \cdot I - I$$

where W , the "net worth increase", is equal to the present value of the future income stream due to the investment minus the cost of the investment. We may note that this specification does not require that each investment project has to be completed within the given period--and for that matter, we do not have to assume any specific lag structure for investment. For example, if a project was started last year, we can envisage additional investment dollars being necessary within this year to complete the project and thus raise the expected net worth of the firm beyond what it would be in the absence of those extra investment dollars. Similarly, a current project need not be completed within the current year. All that need be assumed is that current investment

spending will increase future net incomes. As suggested by Hayashi (1982), lag structures commonly assumed in investment functions reflect either the working of an installation cost or that of some installation effectiveness slack. These considerations underly the flexible accelerator model. To the extent that I is interpreted to include "installation costs" as well as replacement investment it represents spending that will raise the net worth of a firm from that level in its absence. It does not represent a net addition to the capital stock.

In the absence of all taxes and subsidies, investors maximizing W with respect to I would equate $\partial W / \partial I$ to zero, implying that optimal investment is given by:

$$(4) \quad I^* = \frac{g - r}{\frac{1+g}{1+r} \frac{\partial r}{\partial I} - \frac{\partial g}{\partial I}}.$$

As expected, I^* rises with g and falls with r . In addition, I^* falls with $\partial r / \partial I$ and $|\partial g / \partial I|$.

It is possible to introduce the cost of installation explicitly into our model. Let investment expenditure I_0 consist of two elements, capital acquisition cost i_0 and capital installation cost $i_0 c$ where c is the marginal cost of installing equipment. Writing the net worth increase W as:

$$(5) \quad I_0 = i_0 + i_0 c$$

$$\int_0 \frac{1 + q(I)}{1 + r(I)} dI - (i_0 + i_0 c)$$

and setting the first derivative with respect to i_0 equal to zero, we obtain:

$$(6) \quad \frac{1 + q(I_0)}{1 + r(I_0)} (1 + c) - 1 - c = 0.$$

The first term corresponds to Tobin's marginal q .¹³ In other words, net worth maximization requires Tobin's marginal q minus one to be equal to the marginal cost of installation.¹⁴

The rest of this paper will leave the cost of installation implicit so as to simplify the exposition. We now have a simple model based on equation (3) that can be easily expanded to allow analysis of the effectiveness of various investment incentives. Thus, if the corporate tax rate is t , the deduction from taxable income at rate d is immediate, and if an investment subsidy at rate s is available, the net worth increase function becomes:

$$(7) \quad W(t,d,s) = \frac{I(1+g)}{1+r} - I - \frac{t(I(1+g) - d(1+r)I)}{1+r} + sI.$$

The first two terms does not require any further explanation. The third term represents the capitalized value of tax payments. Note that the specification of this term does not imply that taxes are paid at the end of the economic life of the assets. As long as the terminal value of the investment is $I(1+g)$ the time profile of net incomes may take on different patterns without affecting the analysis. The investment subsidy, shown as the last term in equation (7), is assumed to be paid immediately the investment expenditure is made.

It is straight forward to demonstrate that the optimal investment level under these circumstances will be:¹⁵

$$(8) \quad I^*(t,d,s) = \frac{g - r - t(1 + g - d(1+r)) + s(1+r)}{\left(\frac{1+g}{1+r} \frac{\partial r}{\partial I} - \frac{\partial g}{\partial I}\right) (1 - t)}$$

II. Analysis of Cost Effectiveness

We can differentiate (8) with respect to t , d , and s to obtain the marginal effect of a change in the tax rate, the deduction rate, and the subsidy rate on the optimal investment level. We can also differentiate the total revenue cost, to be defined later, with respect to the same variables. The ratio of the former derivative to the latter derivative is the marginal cost effectiveness ratio(MCER).

Similarly, we can divide the total inducement due to each incentive by the total revenue cost of that incentive to obtain the average cost effectiveness ratio(ACER).

Thus, the marginal effect of a tax rate change on investment is found to be equal to:

$$(9) \quad \frac{(1+r)(-1 + d + s)}{\left(\frac{1+g}{1+r} \frac{\partial r}{\partial I} - \frac{\partial g}{\partial I} \right) (1 - t)^2}$$

We may note that this implies that if $d = 1$ and $s = 0$, the marginal effect of a tax rate change on investment is equal to zero. The tax becomes neutral. This agrees with Smith(1963), Stiglitz(1976), Schworm (1979), and Boadway(1980).

We may also note that this expression can be positive. Provided $d(1+r) + s(1+r)$ is large enough, raising the tax rate may lead to larger level of investment. This apparently counter-intuitive result can be easily explained. In the absence of the subsidy, investment will be carried to the point where its marginal contribution to net worth is zero. Beyond this level of investment, additional capital spending brings losses, and tax losses are worth more the higher the tax rate. This is irrelevant, however, in the absence of the subsidy. Once a subsidy for capital spending is available, some of the marginally unprofitable investment will become attractive, and a larger tax rate will increase the value of the tax losses. This is illustrated in Figures 1a and 1b.

In both diagrams we assume $d = 1$, so that the tax rate will not affect the level of investment in the absence of a subsidy. The optimal investment level is I_0^* . Tax rate t_2 is assumed to be higher than t_1 . The effect of a higher tax rate is to shift the marginal discounted profit(MP) line from $MP(t_1)$ to $MP(t_2)$ in Figure 1a. Similarly total

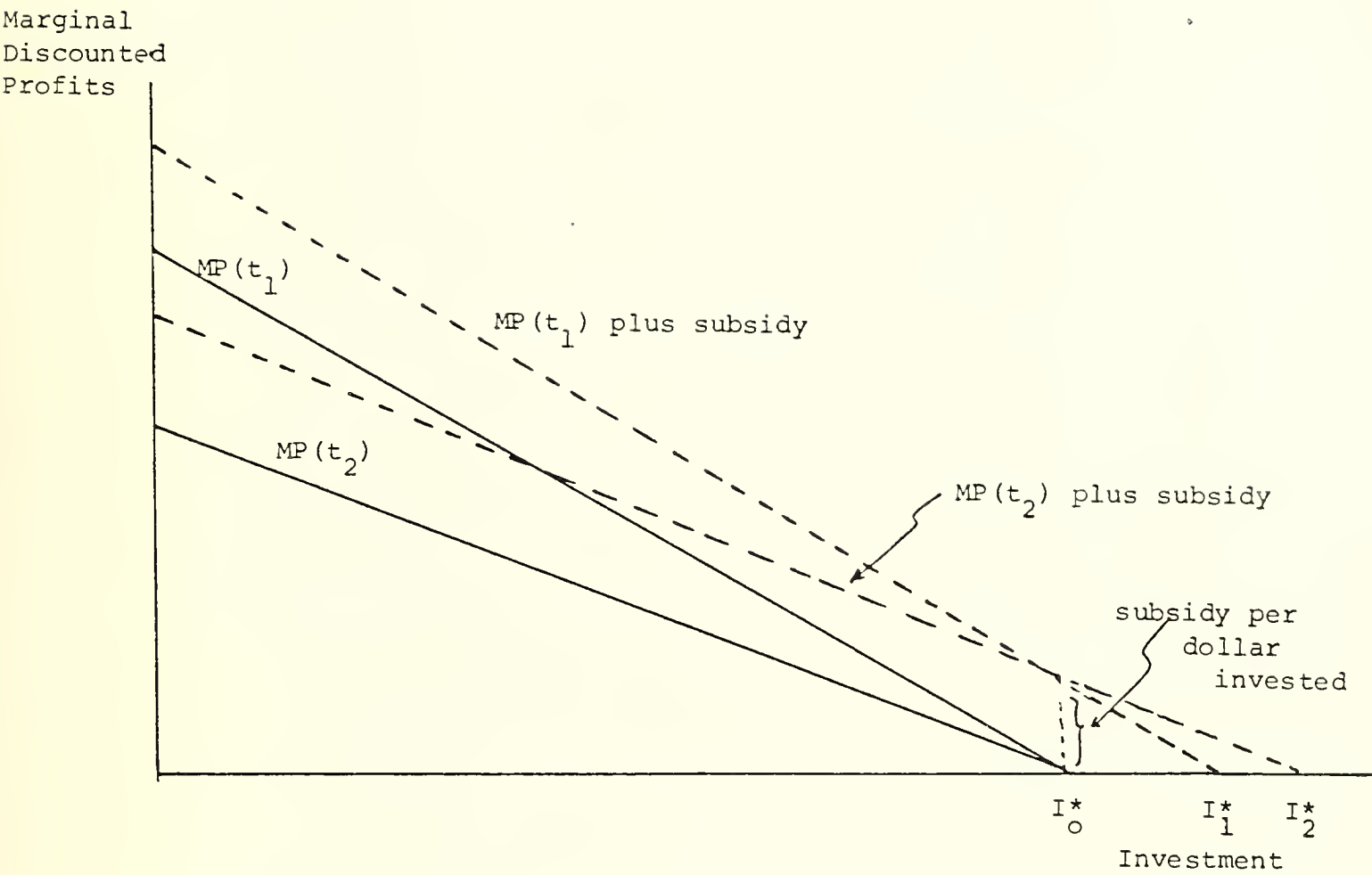


Figure 1a: Higher Tax Rate Could
Favour Investment

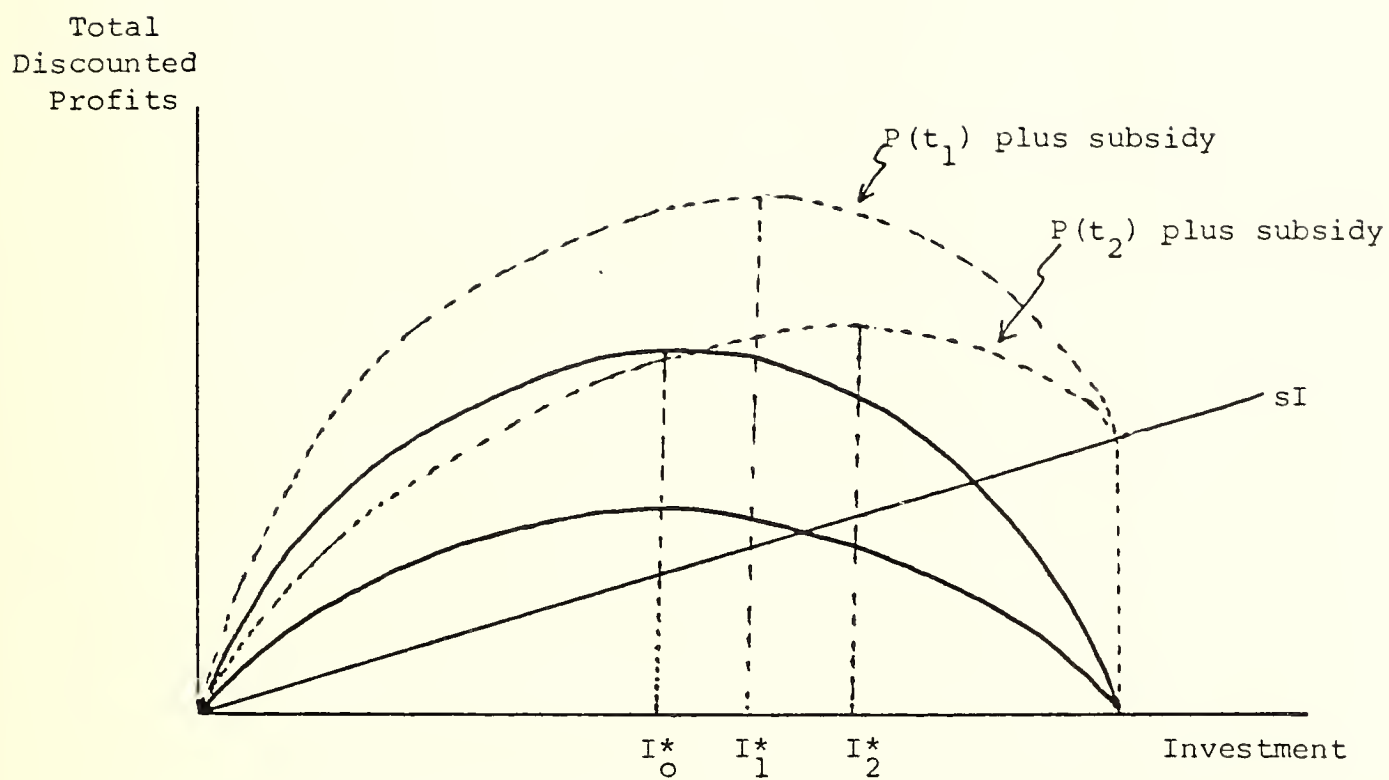


Figure 1b: Higher Tax Rate Could Favour Investment

discounted profit shrinks from $P(t_1)$ to $P(t_2)$ in Figure 2b. Now suppose a subsidy at rate s is given. This shifts the MP schedules up by the amount of the subsidy. As a result optimal investment becomes I_1^* under tax rate t_1 and I_2^* under tax rate t_2 . In Figure 1b the total discounted profit schedules are moved up by the amount $I \times s$. Optimal investment again is shown to increase by more when the tax rate is t_2 than when it is t_1 . In general, in the presence of a large subsidy or large deductions such that $d + s$ exceeds unity, reducing the tax rate will have perverse effect on investment.

Assuming that a tax rate increase causes a decrease in tax revenues, we may represent the marginal revenue cost of a tax rate change by:

$$(10) \quad - \frac{\partial t I^* (1 + g - d(1+r))}{\partial t}$$

The MCER of tax rate change can be obtained by simplifying:

$$(11) \quad \frac{- \frac{\partial I^*}{\partial t}}{\frac{\partial t I^* (1+g-d(1+r))}{\partial t}}$$

$$(12) \quad = \frac{-1}{(1+g-d(1+r)) t (1 + 1/e)}$$

where e is the elasticity of investment with respect to a tax rate change. While expression (12) does not readily simplify to a form that allows numerical interpretation the same approach with regard to the other investment incentives does lead to relatively simple results. Even with (12), moreover, we can conclude that the marginal cost effectiveness of a tax rate reduction depends on the average expected rate of return g , the deductions rate d , the interest rate r , as well as the tax rate itself.

For firms that currently make profits and thus pay income taxes, and for all firms when complete loss offset is available, immediate

deductions are identical to direct investment subsidies. That is, total deductions at $I \times d$ result in an immediate saving of $t \times d \times I$, which is equivalent to subsidizing investment at rate $s = t \times d$. Under such circumstances immediate deductions and direct investment subsidies have exactly the same cost-effectiveness ratios. Writing $td + s$ as S and differentiating (8) with respect to S , we obtain the following marginal inducement to invest:

$$(13) \quad MII(S) = \frac{1+r}{\left(\frac{1+g}{1+r} \frac{\partial r}{\partial I} - \frac{\partial g}{\partial I}\right) (1-t)}$$

The marginal revenue cost of the investment subsidy can be obtained by differentiating SI^* with respect to S :

$$(14) \quad MRC(S) = \frac{g - r - t(1+g) + 2S(1+r)}{\left(\frac{1+g}{1+r} \frac{\partial r}{\partial I} - \frac{\partial g}{\partial I}\right) (1-t)}.$$

Thus the marginal cost-effectiveness ratio for investment subsidies or immediate deductions is:

$$(15) \quad MCER(s,d) = \frac{1+r}{g - r - t(1+g) + 2(1+r)(s+td)}.$$

Similarly, the average cost effectiveness ratio, defined as total inducement divided by total revenue cost of subsidy (explicitly through s or implicitly through d), can be found to be:

$$(16) \quad ACER(s,d) = \frac{1+r}{g - r - t(1+g) + (1+r)(s+td)}.$$

From (15) and (16) it is clear that the cost effectiveness ratios are not affected by treating the discount rate r as a constant rather than a function of the investment level.

By setting $MCER$ (expression (15)) to unity we can determine the critical combined subsidy rate at which the marginal cost-effectiveness ratio becomes unity:

$$(17) \quad S(MCER = 1) = \frac{1 + 2r - g + t(1+g)}{2(1+r)}.$$

Keeping the tax rate constant and allowing g and r to vary, Table 1 shows that as the rate of return improves relative to the discount rate, both the critical subsidy rate and the average cost effectiveness ratio declines.¹⁶

---- Tables 1 and 2 ----

Using the same formulae, we can also compute the critical combined subsidy rates and the associated average cost effectiveness ratios for various combinations of tax rates and rates of return. This is shown in Table 2. The results in this table indicate that both the critical subsidy rate and cost effectiveness rise with the tax rate.

In Table 3, the results for Table 1 are recomputed using a longer time horizon. Comparing the two tables shows that both the critical subsidy rate and the cost effectiveness ratio decline with a longer time horizon.

---- Table 3 ----

The most striking conclusion from the tables, clearly, is that the critical subsidy rate varies significantly with the assumptions. For the assumptions shown, S ranges from zero to 70 per cent, while the average cost effectiveness ratio ranges from under 1 to 3.33.

Finally, Table 4 shows the critical rates of deduction (d') beyond which marginal cost effectiveness falls below unity for a given time horizon and rate of return. Computation is based on the following formula, the derivation of which is straight forward and is based on equation (8).

(18) $d(MCER = 1) = \frac{1 - \frac{g-r}{1+r} + t \frac{1+g}{1+r}}{2t} .$

---- Table 4 ----

Table 1: Critical Subsidy Rates(S') Beyond Which Marginal
Cost Effectiveness Ratios Fall Below Unity, for
Time Horizon of 15 Years and Tax Rate = 40 per cent

g \ r		1.40 (.06) ^a	2.17 (.08) ^a	3.18 (.10) ^a	4.47 (.12) ^a	6.14 (.14) ^a	8.27 (.16) ^a
0.80 (.04) ^a	S' ACER ^b	.60 (2.50)	.47 (1.90)	.30 (1.44)	.09 (1.09)	----	----
1.40 (.06) ^a	S' ACER ^b	.70 (3.33)	.60 (2.52)	.48 (1.91)	.31 (1.46)	.11 (1.12)	----
2.17 (.08) ^a	S' ACER ^b	n.a.	.70 (3.33)	.60 (2.53)	.48 (1.94)	.32 (1.48)	.12 (1.14)
3.18 (.10) ^a	S' ACER ^b	n.a.	n.a.	.70 (3.33)	.61 (2.54)	.49 (1.95)	.33 (1.50)

Notes: a. Brackets indicate implied annual rate. The range of values for g and r are illustrative and may be regarded as nominal rates. Conditions for net worth maximization will not be affected by inflation as long as it is properly reflected in both g and r.
b. ACER = Average cost effectiveness ratio.
n.a. = not applicable.
---- indicate MCER at less than unity when subsidy rate is positive.

Derivation: Based on equations (16) and (17) in the text.

Table 2: Critical Subsidy Rates(S') Beyond Which Marginal
Cost Effectiveness Ratios Fall Below Unity, for
Time Horizon of 15 Years and Discount Rate = 3.18
(10 per cent p.a.)

<div><div>t</div><div>g</div></div>		.20	.25	.30	.35	.40	.45
3.18	S'	.60	.625	.65	.675	.70	.725
(.10) ^a	ACER ^b	(2.5)	(2.67)	(2.86)	(3.08)	(3.33)	(3.64)
4.47	S'	.48	.51	.54	.57	.61	.64
(.12) ^a	ACER ^b	(1.90)	(2.03)	2.19)	(2.38)	(2.53)	(2.78)
6.14	S'	.32	.36	.40	.44	.49	.53
(.14) ^a	ACER ^b	(1.46)	(1.56)	(1.67)	(1.82)	(1.94)	(2.13)
8.27	S'	.11	.17	.22	.28	.33	.39
(.16) ^a	ACER ^b	(1.13)	(1.20)	(1.29)	(1.39)	(1.51)	(1.64)

Notes: See notes to Table 1.

Table 4: Critical Rates of Deduction(d') and Implicit Subsidy Rates(S') Beyond Which Marginal Cost-Effectiveness Falls Below Unity, for Time Horizon of 15 Years and g = 10 per cent p.a.

<div><div></div><div>t</div></div>		.20	.25	.30	.35	.40	.45
<div><div>r</div><div></div></div>							
<div><div>.80</div><div>(.04)^a</div></div>	d'	.355	.52	.62	.70	.76	.80
	s'	.07	.13	.19	.25	.30	.36
	ACER ^b	(1.08)	(1.15)	(1.23)	1.33)	(1.43)	(1.56)
<div><div>1.40</div><div>(.06)^a</div></div>	d'	1.52	1.39	1.30	1.24	1.19	1.16
	s'	.30	.35	.39	.43	.48	.52
	ACER ^b	(1.34)	(1.41)	(1.64)	(1.77)	(1.91)	(2.08)
<div><div>2.17</div><div>(.08)^a</div></div>	d'	2.36	2.02	1.80	1.63	1.51	1.42
	s'	.47	.51	.54	.57	.60	.64
	ACER ^b	(1.90)	(2.02)	(2.16)	2.34)	(2.53)	(2.75)
<div><div>3.18</div><div>(.10)^a</div></div>	d'	3.00	2.50	2.17	1.93	1.75	1.61
	s'	.60	.63	.65	.68	.70	.72
	ACER ^b	(2.50)	(2.67)	(2.85)	(3.07)	(3.33)	(3.64)

Notes: a. Brackets indicate implied rate of discount per year.
b. ACER = average cost effectiveness ratio.
Derivation: Based on equations (18) and (16) in the text.

III. Effect of Risks

So far our analysis has ignored the role of risks. With less than complete loss offset and in an environment of uncertainty, deductions from taxable income will no longer be equivalent to direct investment subsidies unless investors are risk-neutral. Following Hirshleifer(1970), the effect of risks can be captured through the use of a higher discount rate r' that includes a risk premium $r' - r$ over the risk-neutral or riskless discount rate r . Suppose deductions DI are expected on investment I at the end of the period such that $tDI/(1+r)$ is equal to sI , where s is the rate of investment subsidy to serve as a benchmark for comparison, so that the (risky) deductions are expected to cost the same as the (riskless) investment subsidy. The net worth increase function facing the investor with both deductions and subsidies permitted is:¹⁷

$$(19) \quad W(\text{risk-discounted}) = \frac{I(1+g)}{1+r'} - I - \frac{t(I(1+g) - DI)}{1+r'} + sI$$

Maximizing this with respect to I shows that the inducement resulting from a direct investment subsidy is equal to:

$$(20) \quad \frac{s(1+r')}{\left(\frac{1+g}{1+r'} - t \frac{1+g-D}{1+r'}\right) \left(-\frac{\partial r'}{\partial I}\right) - (1-t) \frac{\partial g}{\partial I}}$$

The inducement from the deductions with identical expected cost, on the other hand, is equal to:

$$(21) \quad \frac{tD}{\text{denominator}}$$

where $D = s(1+r)/t$ from the equal cost condition, and "denominator" is the same denominator as in (20). (21) immediately simplifies to:

$$(22) \quad \frac{s(1+r)}{\text{denominator}}$$

which is smaller than (20). Thus, to the extent that investors are risk-averse, direct investment subsidy would be more cost-effective than deductions in stimulating investment--unless the deductions are riskless,

as when complete loss offset is available. The same argument can be made to demonstrate that a non-refundable investment tax credit will be less cost-effective than a direct investment subsidy for stimulating investment. By the same token, if the capital market is less than perfect and the safe-harbor leasing provisions do not allow costless transfer of unused tax credits, a direct investment subsidy would be superior to transferable investment tax credits under the safe-harbor leasing provisions in terms of cost-effectiveness.

IV. Conclusions

In the foregoing we have derived a simple expression for the level of optimal investment in the presence of tax, deductions, and a subsidy:

$$(8) \quad I^*(t,d,s) = \frac{g - r - t(1 + g - d(1+r)) + s(1+r)}{\left(\frac{1+g}{1+r} \frac{\partial r}{\partial I} - \frac{\partial g}{\partial I}\right) (1 - t)}$$

A reduction in the tax rate with a revenue cost identical to that of an increase in the deductions rate would have the same impact on the numerator. The tax rate reduction operates through t and its multiplicand, while the deduction rate increase operates through d and its multiplicand. A tax rate reduction will, in addition, increase the magnitude of the denominator. This indicates that reducing the corporate tax rate is inferior to raising the deductions rate or direct investment subsidies as a means of stimulating investment. This result is largely due to the effect of diminishing returns to investment, as indicated by the negative sign of the derivative of g with respect to investment.

We have seen that under conditions of perfect certainty, or risk neutrality, or when complete loss offset is available, deductions from taxable income and direct investment subsidies are equivalent. Under conditions of risk averseness and in the absence of complete loss

offset direct investment subsidies are in general more cost effective than deductions or investment tax credits of the non-refundable kind.

Our analysis has also shown that the cost effectiveness of the various incentives is highly sensitive to changes in the expected rate of return, the discount rate, and the time horizon of the projects under consideration. Consequently the same incentive is likely to have different impacts on different firms and sectors.

Footnotes

1. The most popular models used in econometric studies in this area appear to be those of Jorgenson(1967) and Coen(1971). Both models can be considered to have evolved from the flexible accelerator model to the extent that each firm is assumed to be adjusting toward a "desired" stock of capital. Among other empirical studies are: Gordon and Jorgenson(1976), Harman(1977), Harman and Johnson(1978), Auerbach and Summers(1978), Scotland(1981), Dungan, Crocker, and Garesche(1983), and Braithwaite(1983). Palash(1978) is an earlier analytical attempt at obtaining the relative effectiveness of alternative investment incentives.
2. Chirinko and Eisner(1983) noted that none of the six major macroeconomic models surveyed in their paper is well equipped to analyse the effects of changes in tax parameters on investment(p.163) and that "one can get almost any answer one wants by making sure that the chosen model has specifications appropriate to one's purpose." (p.139) The six models are BEA, Chase, DRI, Michigan, MPS and Wharton.
3. Auerbach and Summers simulated the effects of alternative investment tax credit regimes for the U.S. in the historical period 1964 to 1976. Since the credits applied only to investment on machinery and equipment, other forms of investment tended to be "crowded out." They found that the investment tax credit "has tended to destabilize the dynamic behaviour of the economy, and that the 'bang per buck' of incentive stimulus is much smaller than has been assumed." (p.34)
4. Using the Candide 2.0 model, Braithwaite concluded his Canadian simulation thus, "On the basis of the cost/benefit ratios we have obtained, we would have to conclude that at least two of the three investment incentives under study(i.e., tax rate reduction and the investment tax credit) could be made to generate investment well

in excess of the revenue loss(es) involved."(p.47)

5. It is important to note that a cost-effectiveness ratio is not a benefit-cost ratio. As long as the economy is underinvesting and stimulation of investment is deemed desirable, however, an incentive with a higher cost-effectiveness ratio is to be preferred to one with a lower cost-effectiveness ratio.
6. Refundable investment tax credits and transferrable investment tax credits, as those under the safe harbor leasing provisions, can be looked upon as variants of direct investment subsidies. Given that "there is a widespread feeling that the sellers of tax benefits are only receiving a fraction of their value," (Business Week, December 21, 1981) transferrable investment tax credits are not exactly equivalent to direct investment subsidies.
7. See the survey by Richard Bird(1980).
8. Jorgenson noted that "maximization of the present value of the firm is the only criterion consistent with utility maximization."(Jorgenson, 1967)
9. Summers recently used the q theory approach to analyse the effects of taxes and incentives on investment. "the results suggest that the most desirable investment incentives are those that operate by reducing the effective purchase price of new capital goods. They maximize the investment 'bang for the buck' and minimize the windfall to corporate shareholders upon enactment." (1981, p.118)
10. See Hayashi(1982).
11. Keynes saw no difficulty in building an aggregate MEC concept from the micro level. See Keynes(1973), pp.135-136.
12. See Duesenberry(1958). More recently, Sarantis(1979) made the argument that internal financing is cheaper than external financing because of the favourable tax treatment of capital gains and because managers

- receive a considerable portion of their remuneration in the form of stock options. Given the risks associated with external financing they would generally opt for internal financing.
13. If \$1 is the replacement value of the capital asset under consideration, this term represents the market value when it has been installed.
 14. ch. Abel(1977) and Yoshikawa(1980).
 15. While discussions of the conditions for the investment level to be optimal is common in the literature, as in Bradford(1981) and Boadway(1980) , I do not know of any study that has generated a comparable expression for the optimal level of investment.
 16. As stated earlier, these cost-effectiveness ratios are not benefit-cost ratios. We have ignored the question of how to measure the social benefit of investment or the social cost of the revenues taken up by the incentives.
 17. Strictly speaking, the discount rate for deductions D should differ from that for investment income since the risks involved are different. Ignoring the differences in risk premiums embodied in the discount rate for D and investment income will not affect the conclusions of the analysis.

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